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**First/Second Semester B.E. Degree Examination, Dec.2016/Jan.2017**  
**Engineering Physics**

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing one full question from each module.

2. Physical constants : Velocity of light  $C = 3 \times 10^8$  m/s ;

Plank's constant  $h = 6.625 \times 10^{-34}$  JS ; Mass of electron  $e = 9.11 \times 10^{-31}$  kg ;

Boltzman constant  $K = 1.38 \times 10^{-23}$  JK ; Avagadro number  $N_A = 6.02 \times 10^{26}$  /k mole.

**Module-1**

- 1 a. Show that how Plank's law can be reduced to Wein's law and Rayleigh – Jeans law. (06 Marks)
- b. What is a Wave function? List the properties of wave function. (06 Marks)
- c. Show that group velocity is equal to particle velocity. (04 Marks)
- d. A Quantum particle is confined to one dimensional box of width 'a' in its first excited state. What is the probability of finding the particle over an interval of  $a/2$  marked symmetrically at the centre of the box. (04 Marks)
- 2 a. Explain Black body radiation spectrum. (04 Marks)
- b. Obtain the energy eigen value expression and energy eigen functions for an electron in one dimensional potential well of infinite height. (08 Marks)
- c. What are the characteristics of matter waves? (04 Marks)
- d. The velocity of an electron of a hydrogen atom in the ground state is  $2.19 \times 10^6$  m/s. Calculate the wavelength of the de Broglie waves associated with its motion. (04 Marks)

**Module-2**

- 3 a. Define the terms drift velocity, thermal velocity, mean collision time and mean free path. (04 Marks)
- b. What is Hall effect? Obtain an expression for Hall coefficient. (06 Marks)
- c. Explain the temperature dependence of electrical resistivity in metals and super conductors. (06 Marks)
- d. The Hall coefficient of a specimen of doped silicon found to be  $3.66 \times 10^{-4}$  m<sup>3</sup>/Coulomb. The resistivity of a specimen is  $9.33 \times 10^{-3}$  ohm – m. Find the mobility and density of the charge carrier, assuming single carrier concentration. (04 Marks)
- 4 a. Explain the success of Quantum free electron theory. (06 Marks)
- b. What are intrinsic and extrinsic semiconductors? Obtain an expression for fermi level in intrinsic semiconductors. (06 Marks)
- c. Explain in brief construction and working of maglev vehicles. (04 Marks)
- d. An intrinsic semiconductors has an energy gap of 0.4ev. Calculate the probability of occupation of the lowest energy level in conduction band at 100°C. (04 Marks)

**Module-3**

- 5 a. Obtain an expression for energy density of emitted radiation under equilibrium condition. (06 Marks)
- b. Obtain an expression for numerical aperture in an optical fiber. (05 Marks)
- c. Explain the construction and working of semiconductor laser. (05 Marks)
- d. The angle of acceptance of an optical fiber is 30, when kept in air. Find the angle of acceptance when it is in a medium of refractive index 1.33. (04 Marks)

- 6 a. What is Holography? Explain the recording and reconstruction processes in holography, with the help of suitable diagrams. (06 Marks)
- b. Describe the application of optical fibers in point to point communication with suitable block diagram. (05 Marks)
- c. Explain different types of optical fibers. (05 Marks)
- d. The average output power of Laser Source emitting a laser beam of wavelength  $6328 \text{ \AA}$  is 5mw. Find the number of Photons emitted per second by the laser source. (04 Marks)

**Module-4**

- 7 a. Explain in brief Seven Crystal Systems, with neat diagram. (07 Marks)
- b. Define Lattice, basis, crystal structure and unit cell. (04 Marks)
- c. Explain the procedure to find Miller indices of crystal plane. (04 Marks)
- d. The first order Bragg's reflection occurs at angle  $20^\circ$  in the plane (111). Find the wavelength of X – rays if lattice constant is  $3.615 \text{ \AA}$ . (05 Marks)
- 8 a. Derive Bragg's law for crystal structure. (05 Marks)
- b. Explain the structure of Perovskite crystal structure, with neat diagram. (07 Marks)
- c. List the differences between LED and LCD devices. (04 Marks)
- d. Draw the following planes in a cubic unit cell (100), (110), (111) and (112). (04 Marks)

**Module-5**

- 9 a. Explain the description and working of Reddy's shock tube. (08 Marks)
- b. Describe the various Quantum structures. (04 Marks)
- c. List the characteristics of Reddy's Shock tube. (04 Marks)
- d. Describe the preparation of nanoparticles by ball milling method. (04 Marks)
- 10 a. Describe Acoustic, Ultrasonic, Subsonic and Supersonic waves. (04 Marks)
- b. Explain the structure of different Carbon nanotubes, with neat diagram. (08 Marks)
- c. Describe the principle and working of SEM, with neat diagram. (08 Marks)

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